

YIELDS & RATES



FEDERAL CROP INSURANCE CORPORATION
UNITED STATES DEPARTMENT OF AGRICULTURE

CROP INSURANCE RATES

When all-risk wheat crop insurance was undertaken as a part of the farm program of the Federal government, the Federal Crop Insurance Corporation was faced with much the same actuarial problems as any commercial insurance firm inaugurating a new type of insurance. It had to answer these questions: (1) How much could an applicant insure? (2) What premium rate should be charged?

However, the insurance of a growing crop involves several considerations which are unusual to ordinary commercial insurance. In answer to the first question, commercial insurance usually is written for the value of an existing object. In the case of crop insurance, the crop is not yet in existence, and the insurance is written for either 50 or 75 percent of the "average" yield for the insured farm. It is essential that this average yield be accurately determined, or else the farmer will be under- or over-insured.

In answer to the second question, the rates or premium charged by commercial insurance firms usually are an amount per \$100, the insured amount reflecting a zone or class rate. The rates set by commercial insurance include not only the net cost to cover risk of losses, but also must include a loading for the cost of selling the insurance, management of the company, and a profit.

In the case of crop insurance, the Corporation measures the net amount of "loss-cost" or risk in bushels of wheat for the particular farm being insured and determines an individual farm rate. There is no loading for management or profit, as the Federal Crop Insurance Act provides that in view of the public benefits of the crop insurance program, the Federal government may assume all overhead costs of administration.

WHAT YIELDS AND RATES ARE DESIGNED TO DO

In planning and carrying out the crop insurance program, the Corporation developed an extensive actuarial structure. In preparing the actuarial structure it was assumed that average yields and average crop losses over a representative period in the past would reflect probable average conditions in the future.

PURPOSE OF YIELD AND RATE WORK

The purpose of the yield and rate work was:

1. To determine an average yield for each wheat-producing farm either from history of annual yields or by appraisal. This yield, based primarily on the past, to be the most probable yield which might be expected over a representative period in the future.
2. To determine for each wheat-producing farm, from the history of yields or by appraisal, the annual average crop loss if insured up to 75 or 50 percent of the average yield. Such crop loss for the farm over a representative period in the past to be blended with a county average crop loss figure of the past to form a premium rate for the farm. Thus the rate represents the anticipated average amount of crop loss over a representative future period for the farm.
3. To determine or appraise such average yields and premium rates as accurately as possible so that in the long run, (a) each individual farm would carry its own cost of insurance, (b) each county its own cost, and (c) each state its own cost.
4. To blend into the structure each year the new yield and crop loss experience, as such information becomes available, so that the yields and premium rates would become more accurate as new data became available and so that new trends in production and risk on the farm would be reflected in the yield and rate.
5. To build an actuarial structure for the crop insurance program such as over a representative period of years would provide enough premiums collected to adequately meet the losses paid.

HOW RATES ARE MADE

The keystone of the actuarial structure of the Federal Crop Insurance Program is the yield history of the individual farm. Efforts have been made to measure carefully the yield and risk for each individual farm for which insurance is written, for the following reasons:

1. Figure 1, for example, shows that in a midwestern county for a 9-year period, Farm "A" has averaged 12 bushels an acre, while Farm "B" in the same county has averaged only four bushels an acre. It will also be noted that there is a large year-to-year difference in yields for both of these farms. On the other hand, Farm "C" in an eastern county has an average yield of 30 bushels, made up of a relatively stable annual production. Obviously, the insurance rate structure must take into account such wide differences in yields as exist.
2. The amount of risk also varies from farm to farm, even where the yields are the same. For example, Figure 2 illustrates a case of two farms, both of which have a 9-year average yield of 12 bushels an acre. Farm "A" has experienced two years of serious losses, and has an average "loss cost" of a bushel an acre. Farm "B" on the other hand, has experienced only one minor loss during the base period and has an average loss cost of only two-tenths of a bushel.

However, even though rates determined for individual farms are entirely accurate, this does not mean that during any one year the insurance premiums paid by growers will exactly equal the indemnities paid by those who suffer crop losses. The insurance program may safely assume that over a representative period of years the averages will prevail, but it must take into account the fact that losses vary widely from year to year and frequently adverse weather cycles bring poor crops for a series of years. For this reason, the Corporation is provided with an authorized capital of \$100,000,000, of which \$40,000,000 has been appropriated to enable the Corporation to maintain insurance at a long-range premium rate, despite the possibility of a series of years of poor crops and extensive losses.

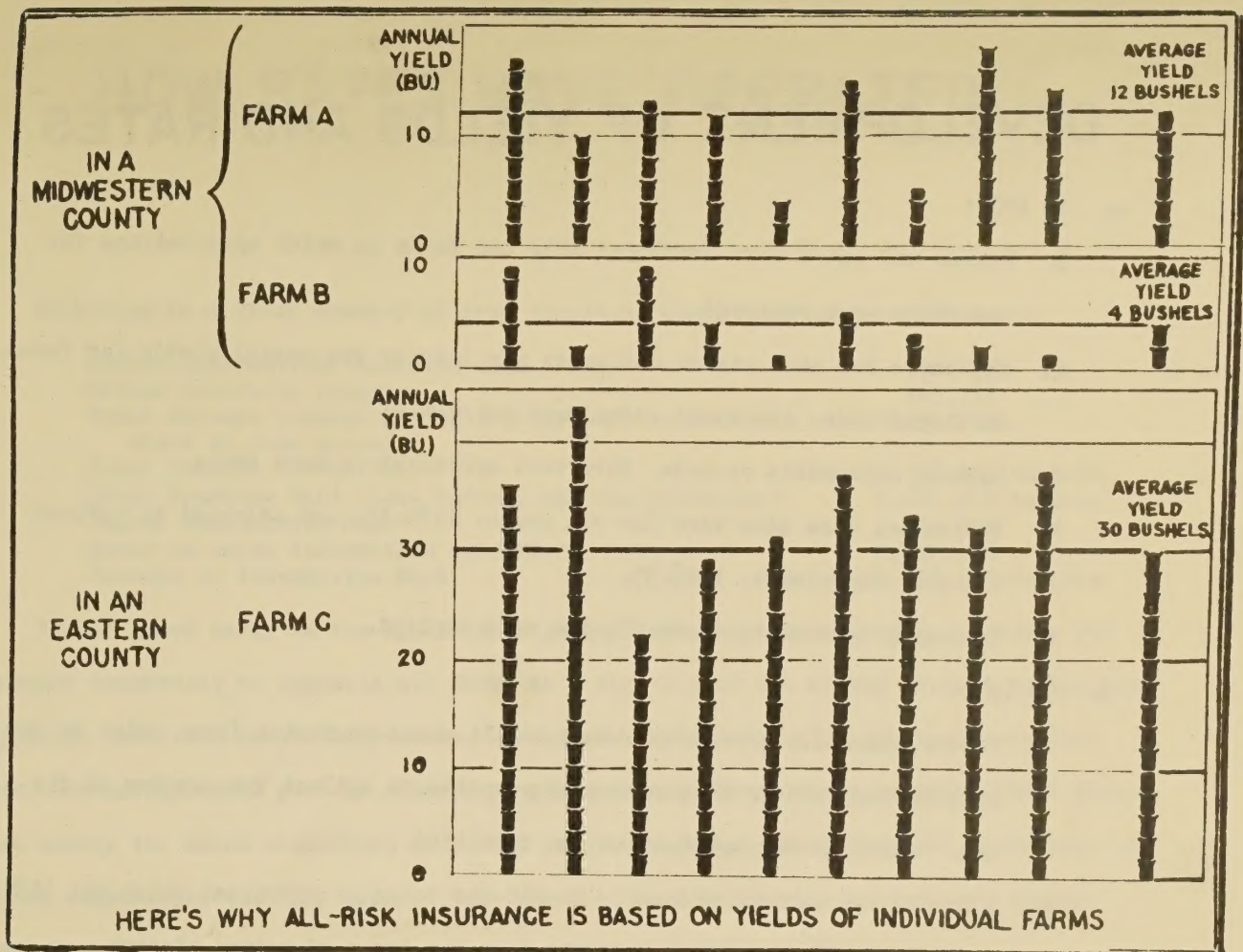


FIG. 1

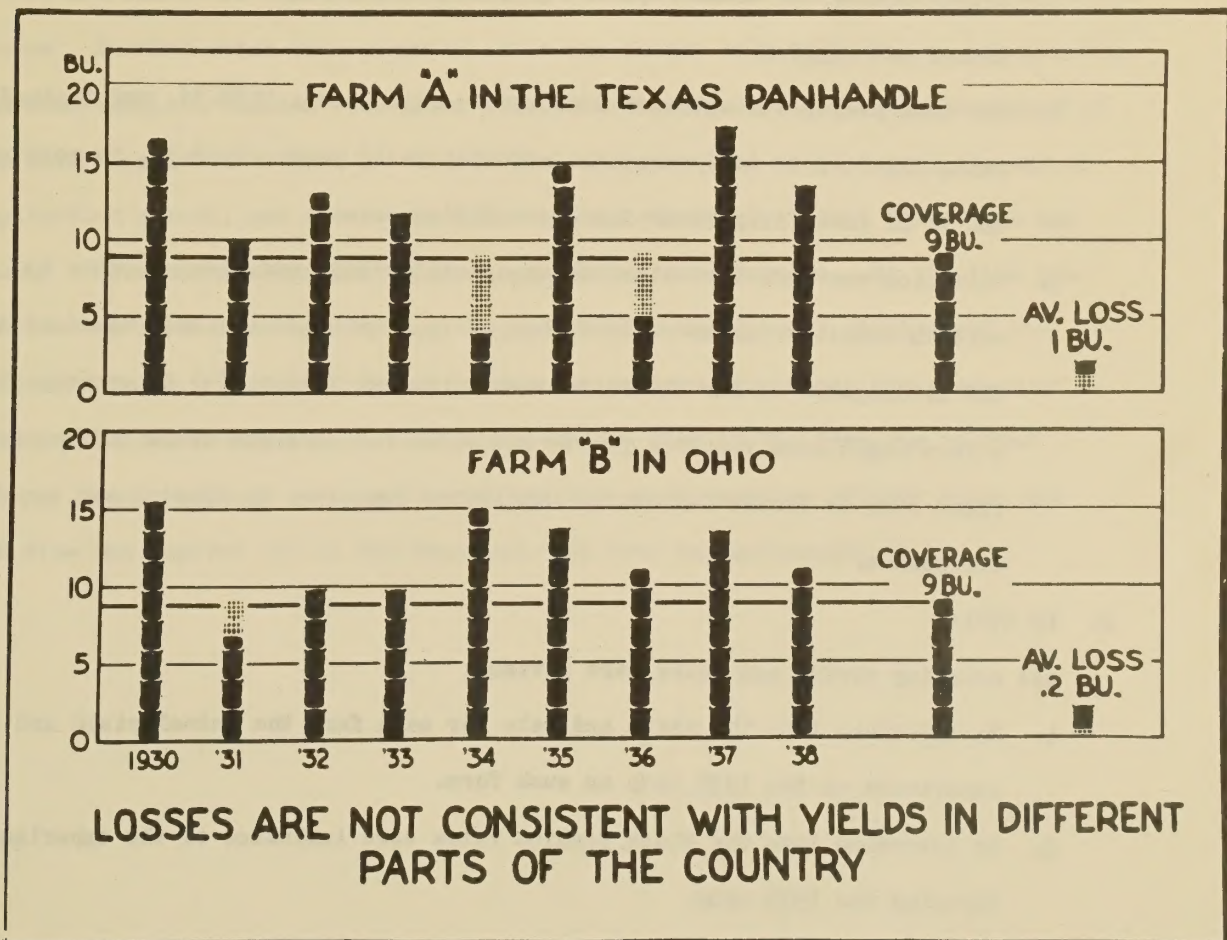


FIG. 2

DEVELOPMENT OF YIELDS AND RATES

A. In 1939:

1. Yields and rates were developed only for farms on which applications for insurance were received.
2. The basis for such yields and rates was largely the annual yields for farms developed under the wheat adjustment program.
3. Lacking dependable records, data were appraised in many cases.
4. Individual farm data were for six years, 1930-35, and adjusted to reflect ten-year experience, 1926-35.
5. No county control or check figures were applied.

B. In 1940:

1. Yields and rates were established on all wheat-producing farms prior to the application period, thus making it possible to collect the premium at the same time that the application was submitted.
2. A method was devised primarily to fit the cases of appraisal which the 1939 program showed to be more numerous than the cases of actual history.
3. County control or check figures for both yields and premium rates were established and applied.
4. The base period was extended from six to nine years, 1930-38, and instead of being adjusted to ten years, was adjusted to 13 years, 1926-38, in most states and to 20 years in part of the Great Plains area.
5. Provision was made for establishing special yields and premium rates in certain counties (a) to reflect changes in production and risk incident to the development of new practices such as summer fallow, (b) to provide that a farm might have separate yields and rates for acreages under different practices such as summer fallow and continuous cropping, irrigation and non-irrigation.

C. In 1941:

All existing yields and rates were revised:

1. To introduce into the yield and rate for each farm the actual yield and loss experience on the 1939 crop on such farm.
2. To introduce into the check premium rates some influence of the experience on insuring the 1939 crop.

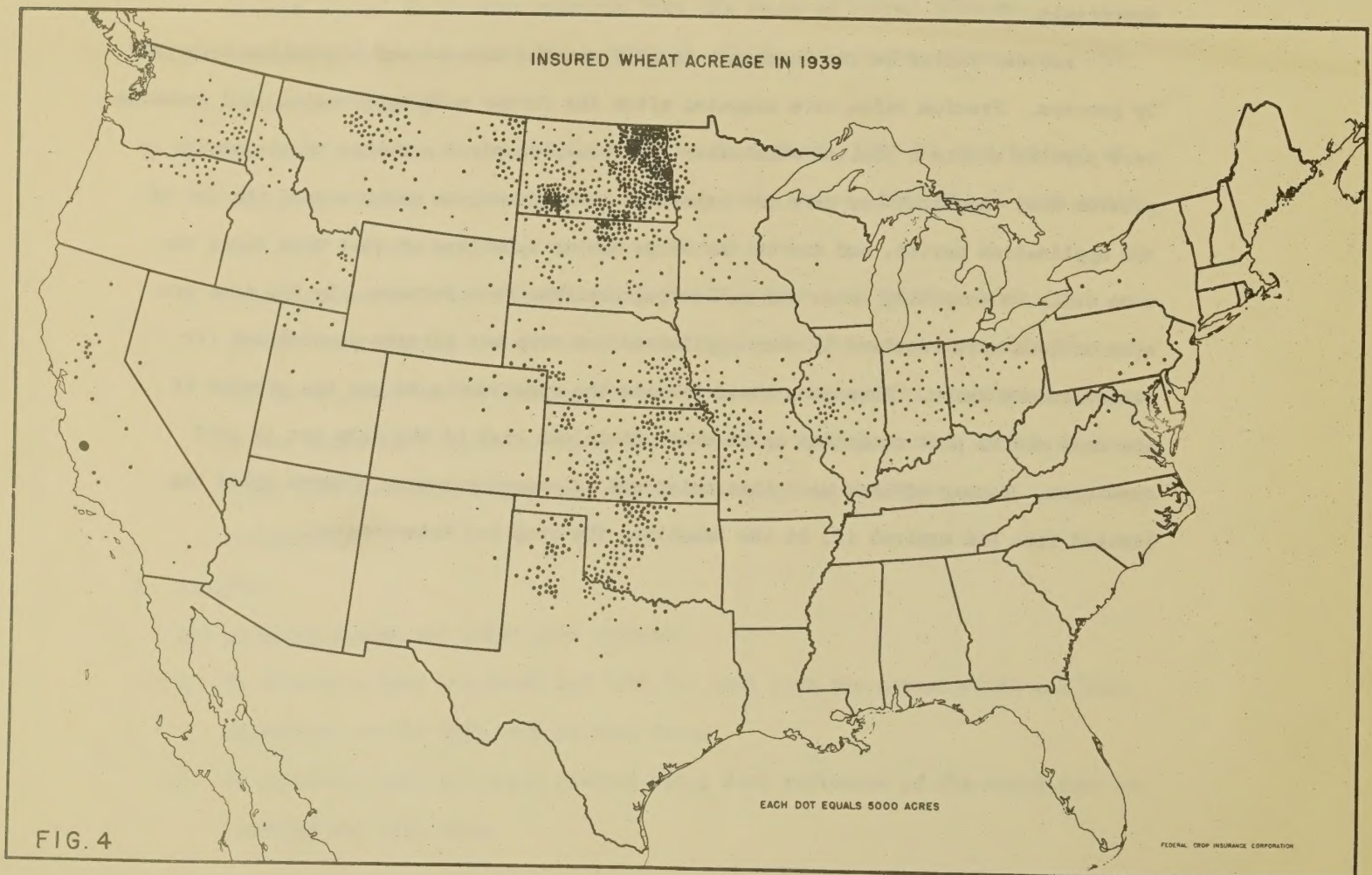
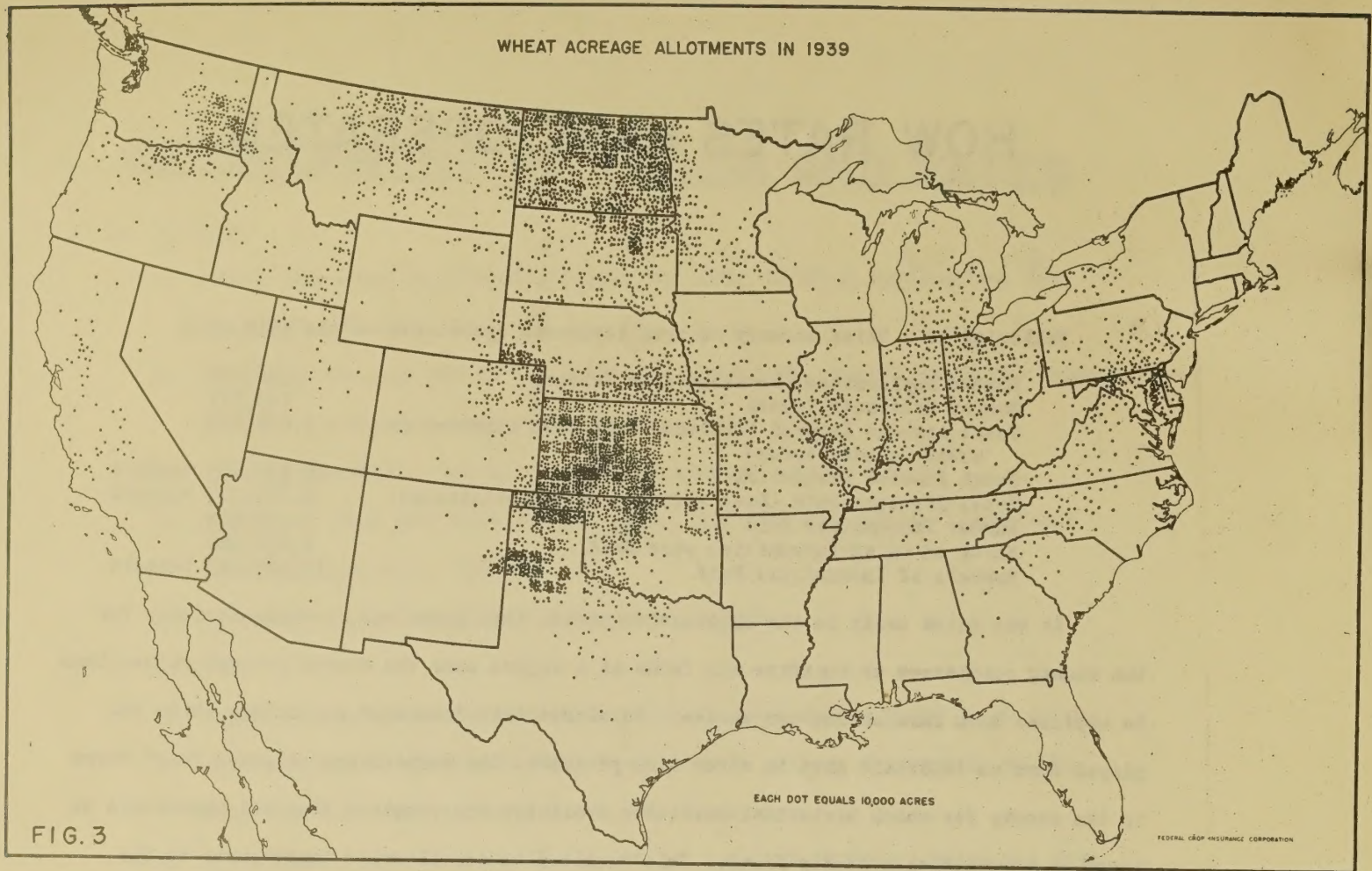
HOW RATES HAVE OPERATED

Following is a brief summary of crop insurance operations on the 1939 crop:

Number Applications Received from Farmers	306,077
Number Contracts Issued	165,777
Total Acreage Insured (Includes only part interest in wheat on some acres)	7,235,050
Total Insured Production	60,839,785 bushels
Total Premiums Paid (Less refunds and cancellations)	6,684,215 bushels
Number Indemnities Paid	55,912
Acres on which Indemnities were Paid	2,610,966
Bushels of Indemnities Paid	10,163,127 bushels

It was noted early in the application period that there was a strong tendency for the county committees to appraise all farms at a figure near the county average rather than to appraise each farm on its own merits. To offset this "average" psychology which had played such an important part in other farm programs, the Corporation selected "key" farms in the county for which historical data were available and required that all appraisals be based on comparisons with key farms. This resulted in considerable improvement in the appraisals.

Another factor in the insurance in 1939 was the time at which premiums were paid by growers. Premium rates were computed after the farmer made application, and premiums were payable within a limited time after the farmer received a notice of the amount of premium due. Applications were not submitted in large volume until toward the end of the application period, and due to the large number submitted at that time there was some delay in computing rates and collecting premiums from farmers. By the time premium notices were received by many applicants the crop was already planted and its condition was known. This gave those farmers the opportunity to pay the premium if the crop was in poor condition or to carry their own risk if the crop was in good condition. County offices were instructed not to accept premiums offered after the limited time had expired if, in the meantime, the crop had deteriorated.



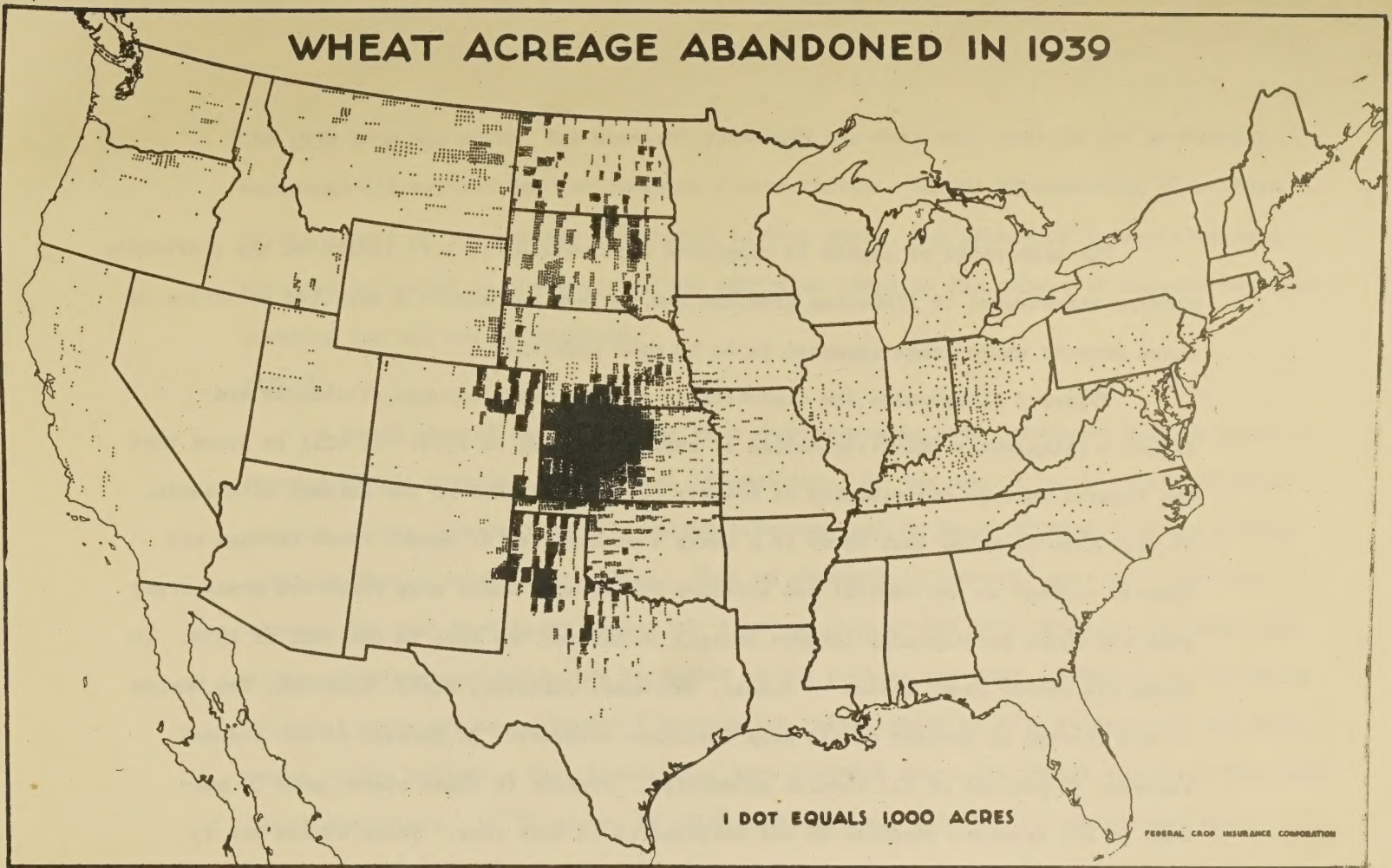


FIG. 5

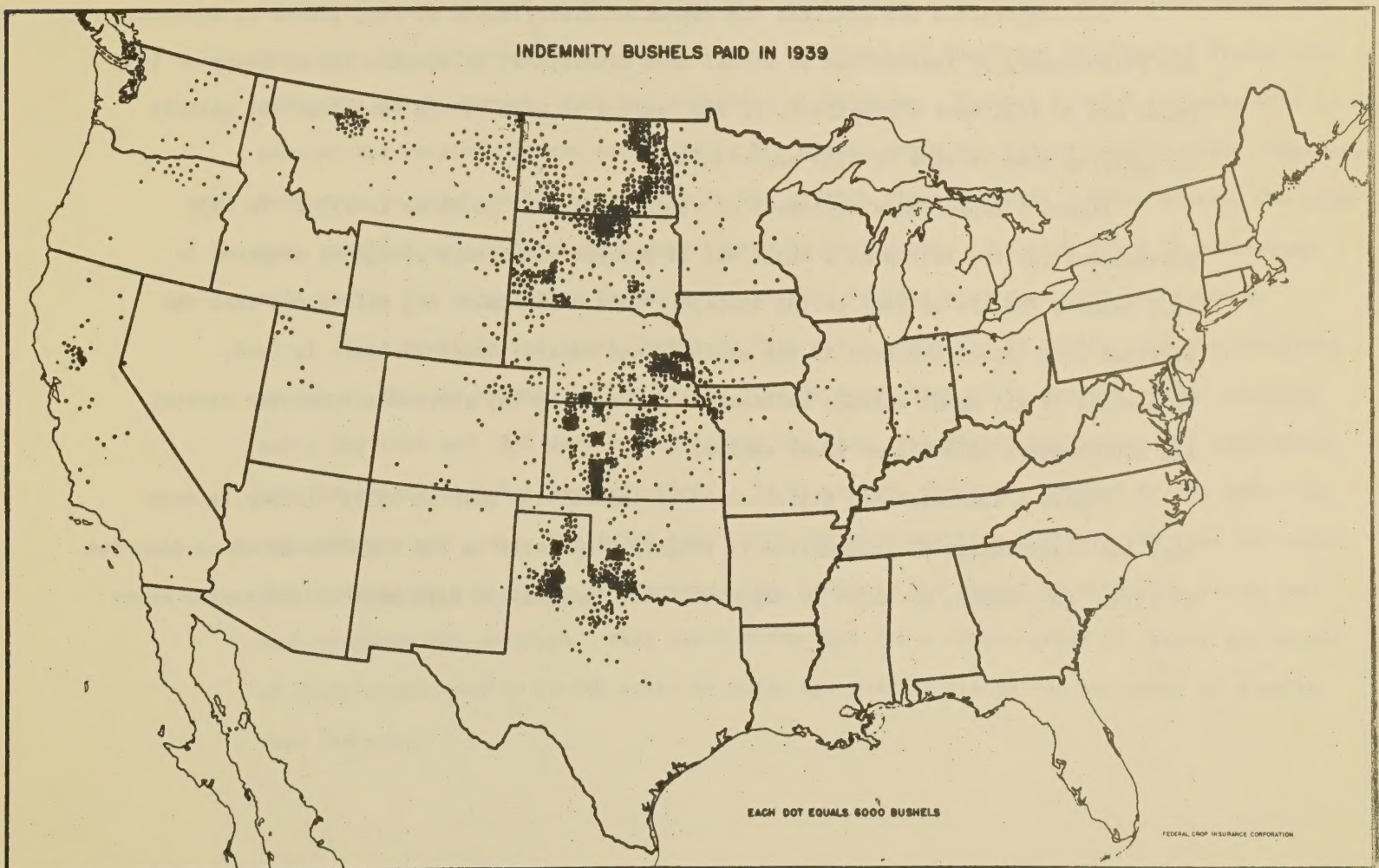


FIG. 6

The high ratio of lapsed to completed applications in part indicates the difficulty growers experienced in financing premiums and in part represents a negative selection by those growers whose crops appeared to be in good condition.

Figure 3 illustrates the distribution of 1939 wheat acreage allotments and Figure 4 illustrates the distribution of acreage insured in 1939. It will be noted that the insured acreage distribution is roughly parallel to that of the acreage allotments. It will also be noted that there is a heavy concentration of normal wheat acreage and insured acreage in the central and southern Plains area where crop risks are great every year and where particularly intense hazards threatened the crop in the fall of 1939. In these six winter wheat states -- Kansas, Nebraska, Oklahoma, Texas, Colorado, New Mexico -- was located 25 percent of all crop insurance contracts, 30 percent of all insured acreage, 30 percent of all insured production. Growers in these states paid 30 percent of all premiums received by the Corporation in that year. These states had 43 percent of the wheat acreage allotments.

EXTENT AND DISTRIBUTION OF LOSSES

The Corporation has analyzed the extent of distribution of 1939 losses to determine the relationship of indemnities to actual loss conditions, to measure the accuracy of 1939 rates and to find what corrections, if any, should be made in the rates and the methods of applying them in view of 1939 experience.

Figure 5 shows the abandonment of wheat acreage by counties in 1939. In 1939 abandonment for the Nation as a whole was 16 percent of acreage seeded as compared to 15.5 percent for the 10-year period 1926-35. This abandonment map also shows that the heaviest crop losses occurred in the southern and central Great Plains. In fact, 72 percent of all wheat acreage abandonment occurred in the above-mentioned six central and southwestern hard winter wheat states.

Figure 6 indicates the distribution of indemnities paid in 1939. It may be seen that the distribution of indemnities is roughly comparable to the abandonment which occurred in 1939. In general, as might be expected, most indemnities were paid in the states where

the 1939 crop was poor. The heaviest indemnity payments were made in the previously mentioned six central and southwestern Plains states. Claims representing 47 percent of the amount of indemnities originated in this area. The excess of indemnities over premiums collected in these states was nearly as large as the excess of indemnities over premiums for all states combined.

YIELDS

A broad general assumption has been made regarding crop insurance that in years of average yields premiums should equal indemnities. By the same rule, in years of below-average yields, indemnities will outrun premiums, and in years of above average yields, premiums should exceed indemnities. Such an assumption, however, does not take into account the fact that heavy losses may occur on part of the crop while at the same time higher-than-average yields are harvested on the rest of the crop. However, on the basis of broad state averages, Figure 7 showing the relationship of 1939 indemnities and 1939 wheat yields indicates that indemnities were somewhat above the amount expected under such yield conditions. Of 31 states in which insurance was written, 15 experienced above-average yields and 16 experienced below-average yields. Indemnities exceeded premiums in 17 states, were even with premiums in 3 states, and were less than premiums in 11 states. It should be noted that in the central and southwestern hard winter wheat belt, where the insurance was concentrated, the states with the heaviest insurance experienced yields considerably below average, with the exception of Oklahoma. Figures 7 and 8 indicate that in general the heaviest losses were paid in the states where the yields were poorest. However, this area in which losses were heavy is one of high risks and high premium rates. The high rate resulted from similar crop experiences in past years. The high rates in such areas will enable the Corporation to build its reserve rapidly when good crop years occur.

It is possible for local losses to vary while state yields remain near the long-time average. This is illustrated by Figure 9 which shows that state average yields and loss costs for 1926 and 1936 were approximately the same, yet yields and losses for individual crop reporting districts varied widely. In Figure 10, farms are arrayed by the amount of the coverage per acre. The solid bars below the coverage line indicate the loss per acre. The cross hatch bars above the coverage line indicate the amount by which the yields per acre exceeded the coverage. This chart shows that for a county group of farms, the amount of loss varied greatly in two years in which the average yields for the group as a whole were the same.

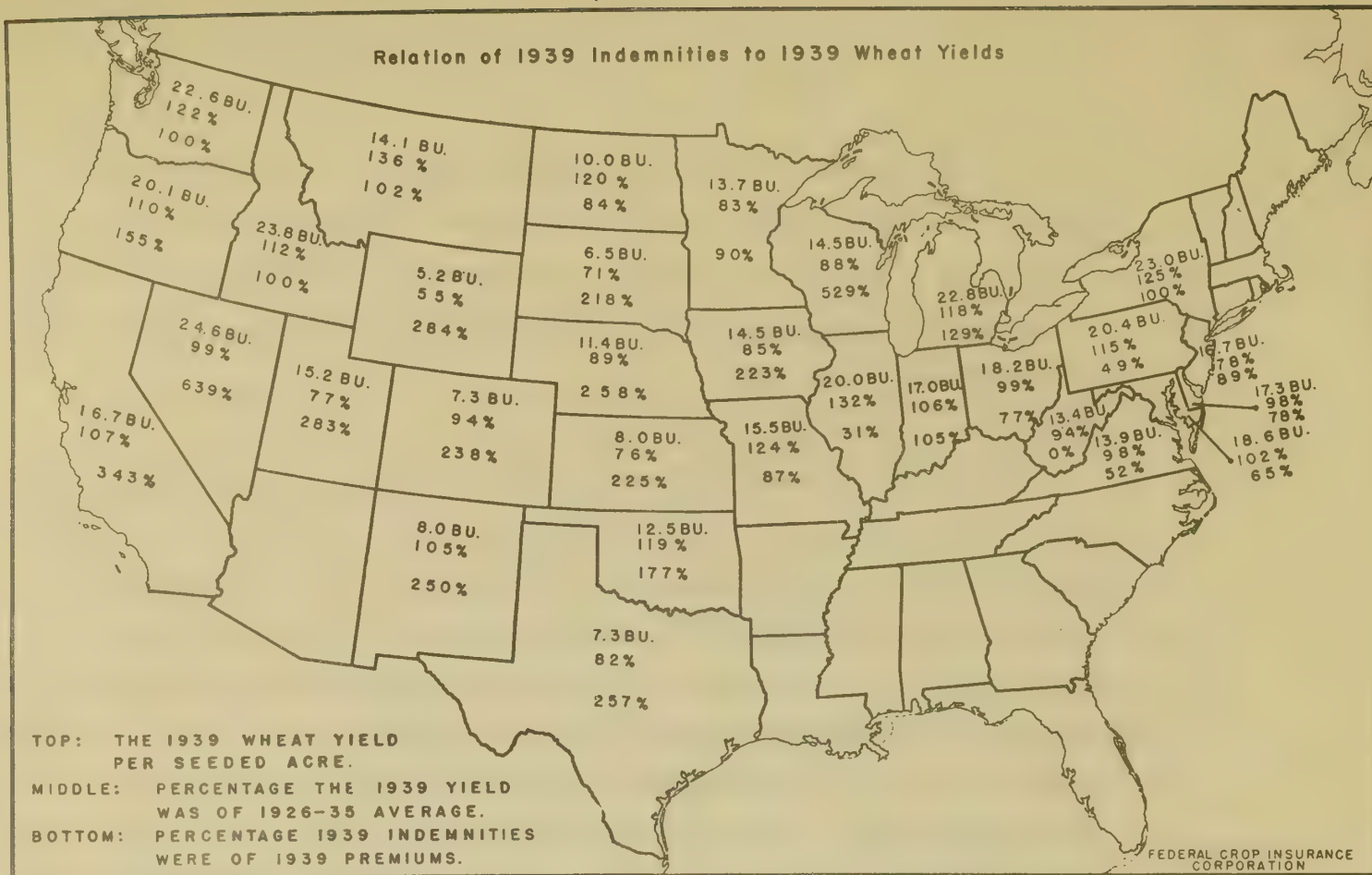


FIG.7

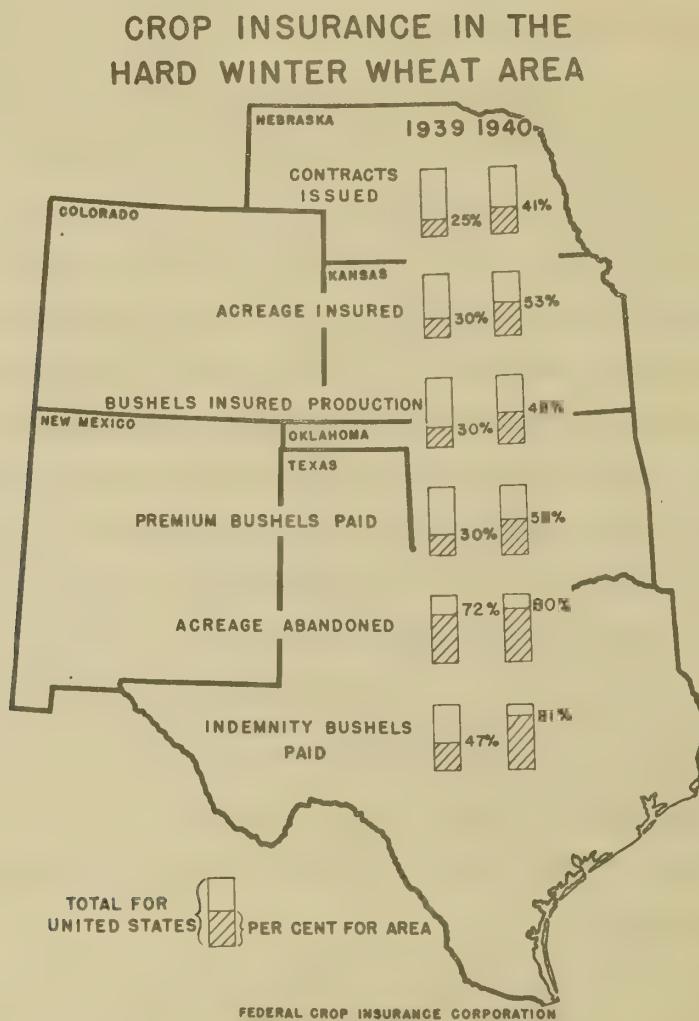


FIG.8

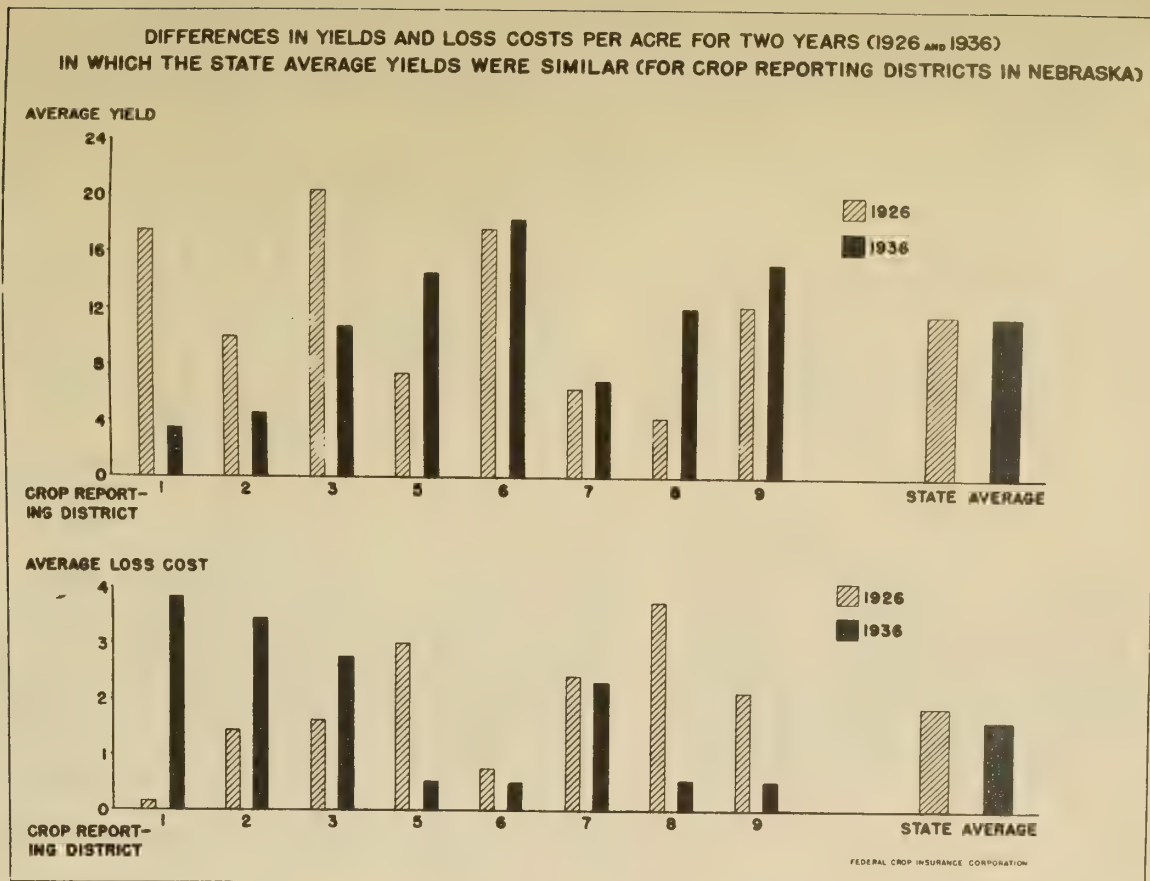


FIG. 9

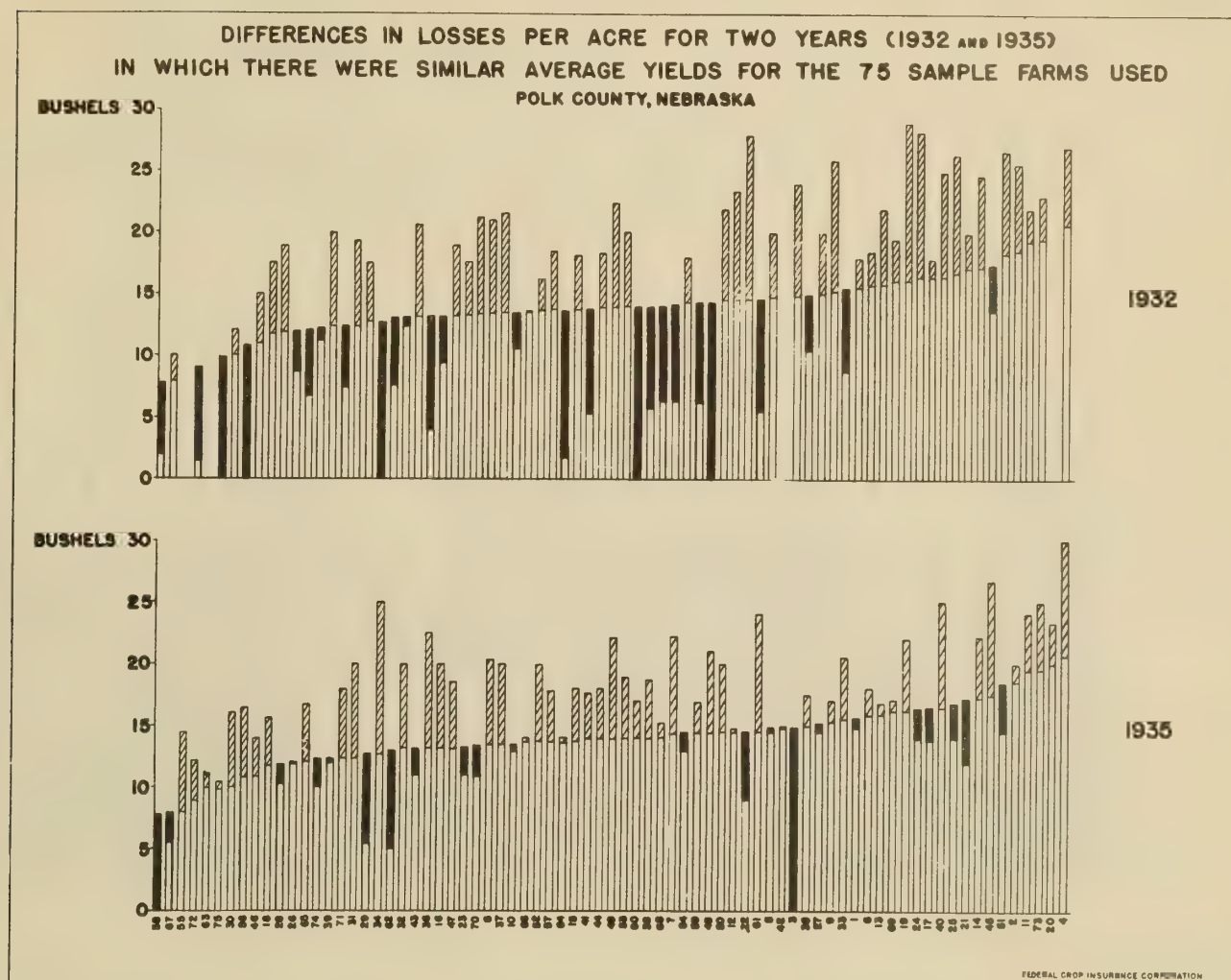


FIG. 10

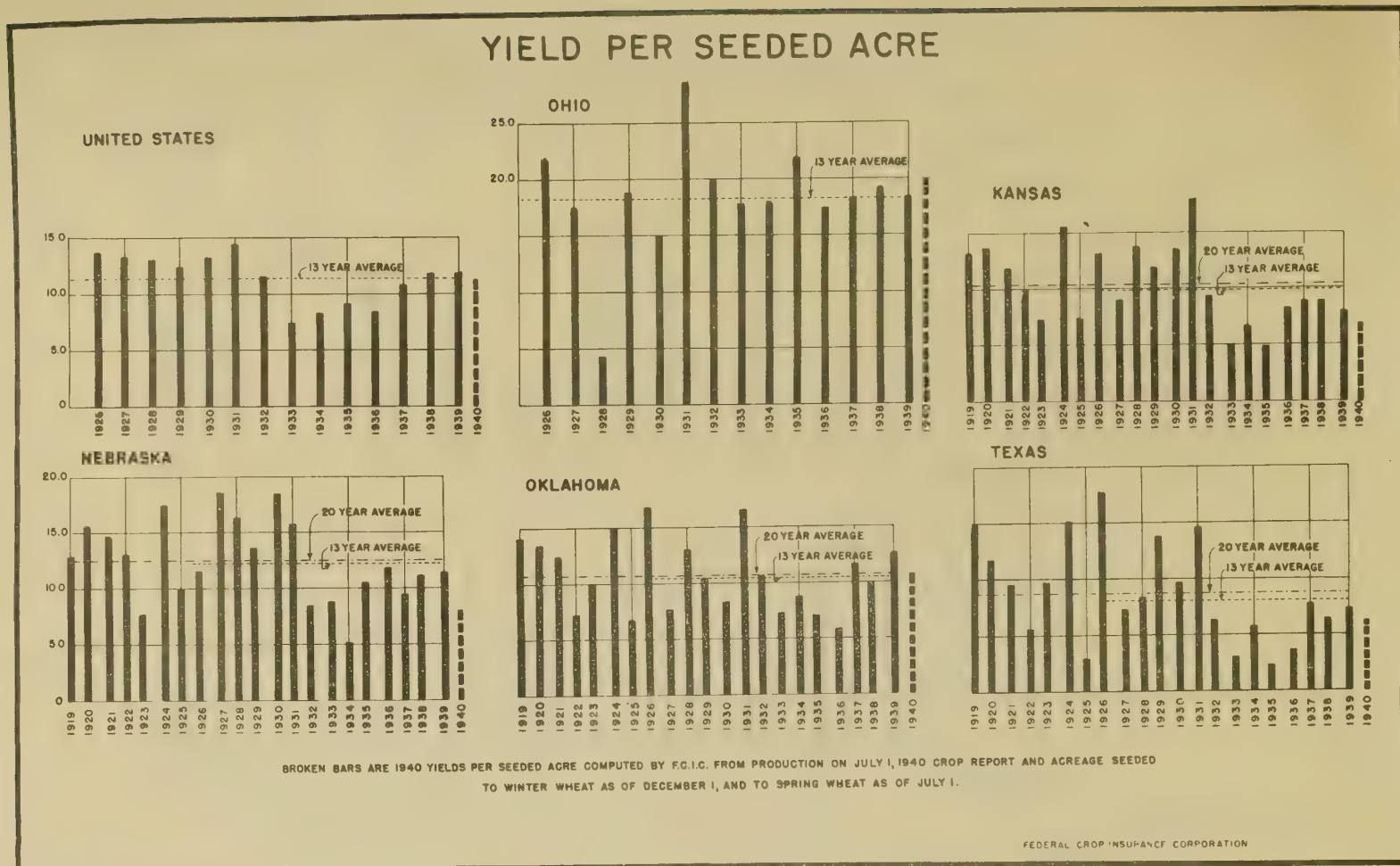


FIG. 11

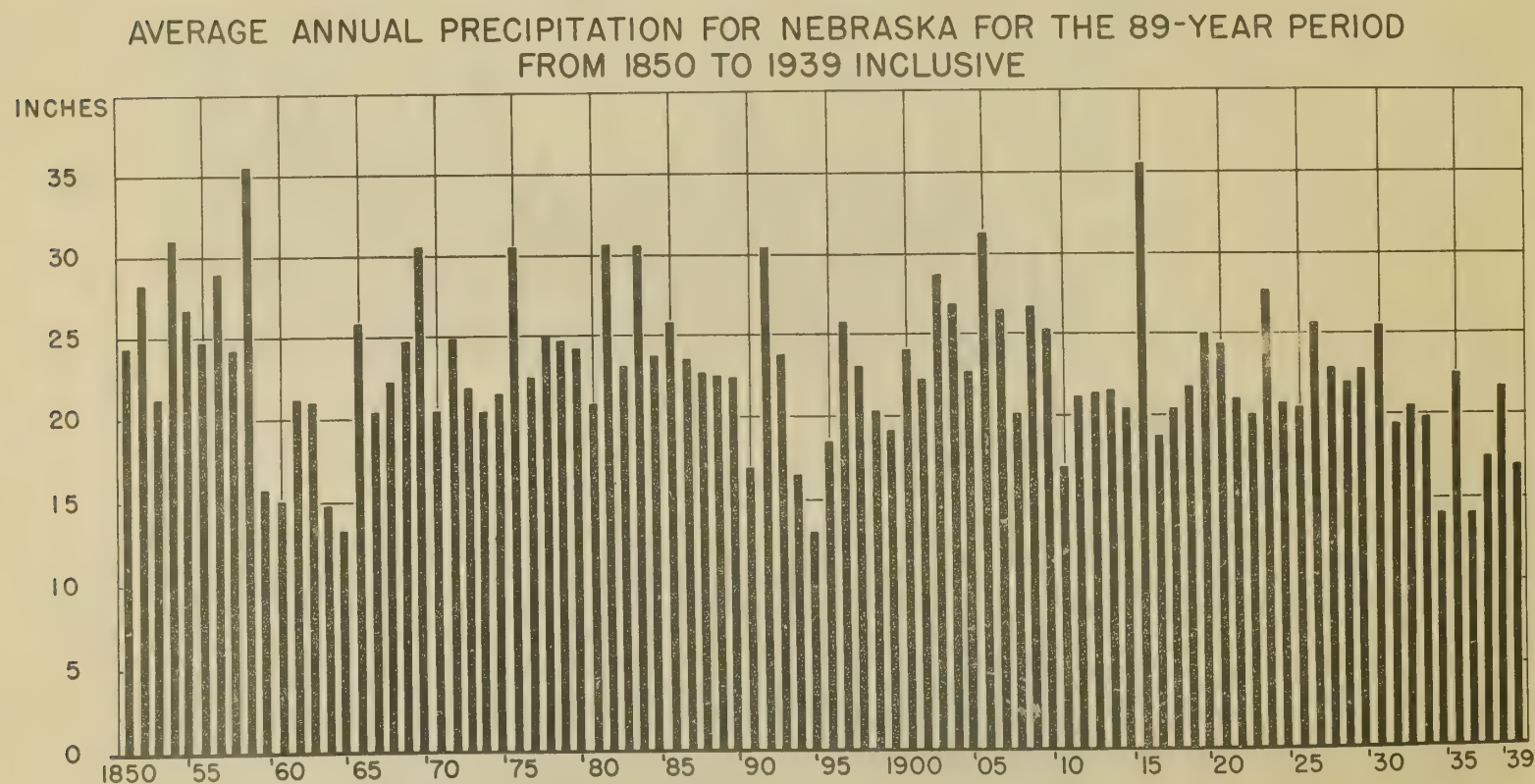


FIG. 12

Figure 11 indicates the wide fluctuation in even such broad averages as state yields, as compared with the national average.

Figure 12, showing the annual rainfall for the 89-year period for Nebraska, a typical hard red winter wheat belt state, shows that the rainfall during 1939 was considerably below the long-time average, and, consequently, above-average losses were to be expected. This chart reveals that wheat growers in this area have been in a dry cycle for the past six years, a drought period as serious as the two previous great droughts indicated on the chart that have occurred. If rainfall conditions return to normal, as they always have in the past, the relationship between losses and premiums paid in this area should also return to normal. In other words, the long-range premium rates under which the program is now operating should be sufficient to meet the long-range losses which may be experienced.

CONCLUSIONS - 1939

The Corporation's analyses of the operation of yields and premium rates in 1939 are the basis of the following conclusions:

1. The general yields and premium rates developed in 1939 were as accurate as it was possible to obtain at that stage of the program. While the need for a number of improvements was indicated, the general experience would seem to prove that the program is feasible and that the basic principles on which the program was built are actuarially sound.
2. Since a large proportion of the insurance contracts were in a high loss area for that year, heavy indemnity payments were to be expected. However, some part of the loss might be charged to difficulties encountered in the operation of a new program such as adverse selection of risks due to delayed closing dates, inadequate application of actuarial data in the field, and inability to establish adequate controls during the first year. However, indemnities were not excessive to such an extent that the discrepancy cannot be removed through improvements such as have been adopted for insurance in subsequent years.
3. Studies show that the insurance experience was more in line with the actuarial basis in those counties where the volume of insurance was large, and where participation had a greater opportunity to be representative of the range of wheat growing conditions in the county. This would indicate that increased participation in the program will bring it more closely in line with the actuarial structure.

IN 1940

Following is a brief summary of crop insurance operations on the 1940 wheat crop:

Number Applications Made and Contracts Completed	379,521
Total Estimated Acreage Insured (Includes only part interest in the wheat crop on some acres)	11,986,131
Total Estimated Insured Production	107,667,020 bushels
Total Premiums Paid	14,171,979 bushels

*Number Indemnities Paid as of September 5, 1940 64,074

*Bushels of Indemnity Paid as of September 5, 1940 14,261,994

*As of this date all indemnities due on the 1940 crop have not yet been paid.

Figure 13 illustrates the distribution of acreage allotments in 1940 and Figure 14 illustrates the distribution of insured acreage. It will be noted that the distribution of the insurance is rather uniformly in proportion to the distribution of acreage. There was a general increase in participation over 1939 of 129 percent for the country as a whole. This rapid growth of crop insurance may be attributed to several factors, including:

1. Demonstration of the program in 1939.
2. Realization of the danger of crop loss from 1939 experience.
3. Availability of ACP advances to pay premiums. These advances were not available to winter wheat growers in 1939 as legislation authorizing them was not enacted until after the 1939 winter wheat insurance program closed on applications.
4. Development of the late summer drought over much of the Nation's winter wheat belt.

In the six central and southwestern wheat states -- Kansas, Nebraska, Oklahoma, Texas, Colorado, and New Mexico -- where normally 37 percent of all the Nation's wheat is produced were 41 percent of all the 1940 contracts, 53 percent of all insured acreage, 48 percent of all insured production. Because of the greater risk to which they had been exposed in the past, growers in this area paid higher premium rates than in other areas, accounting for 58 percent of all premium bushels received by the Corporation.

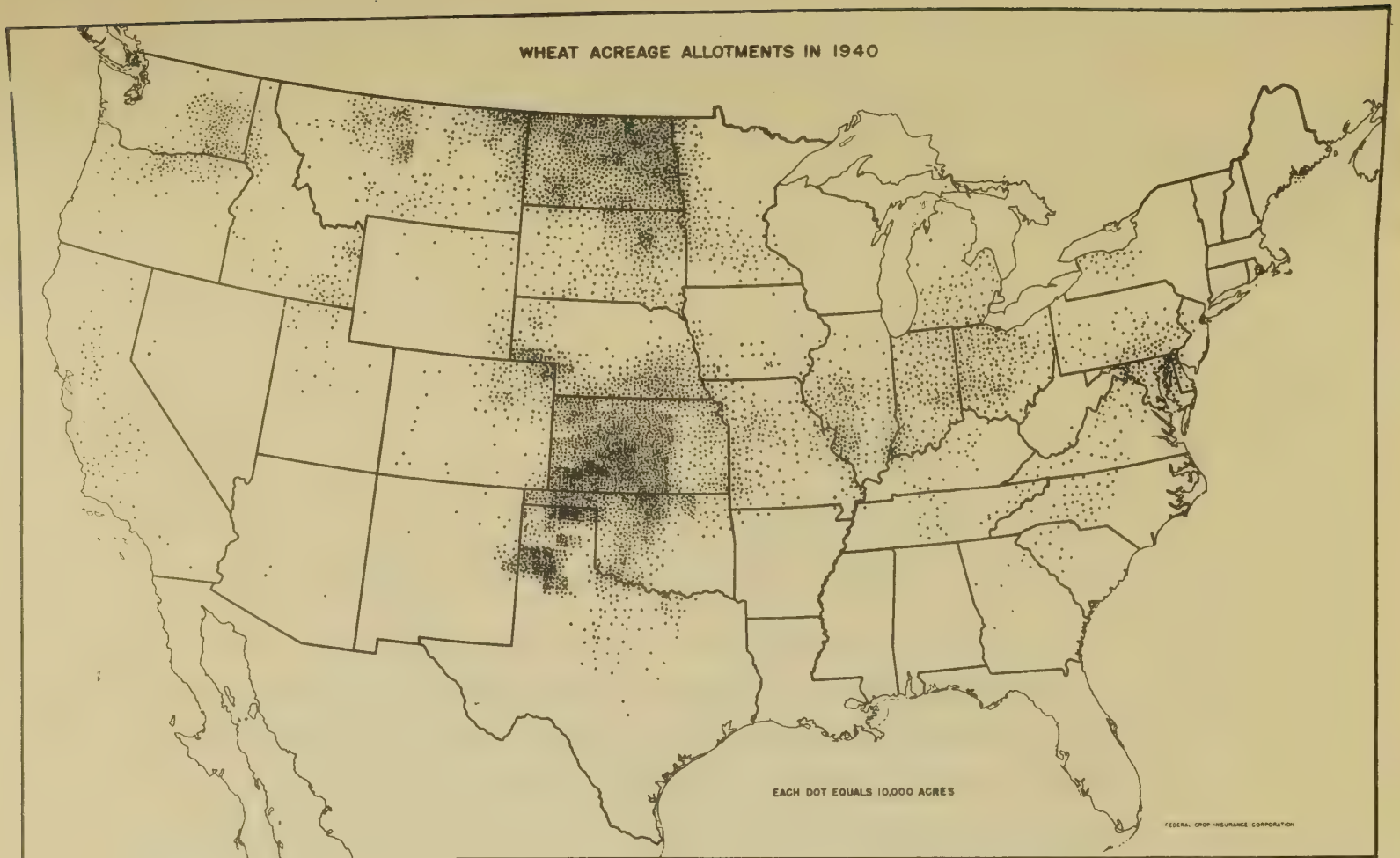


FIG. 13

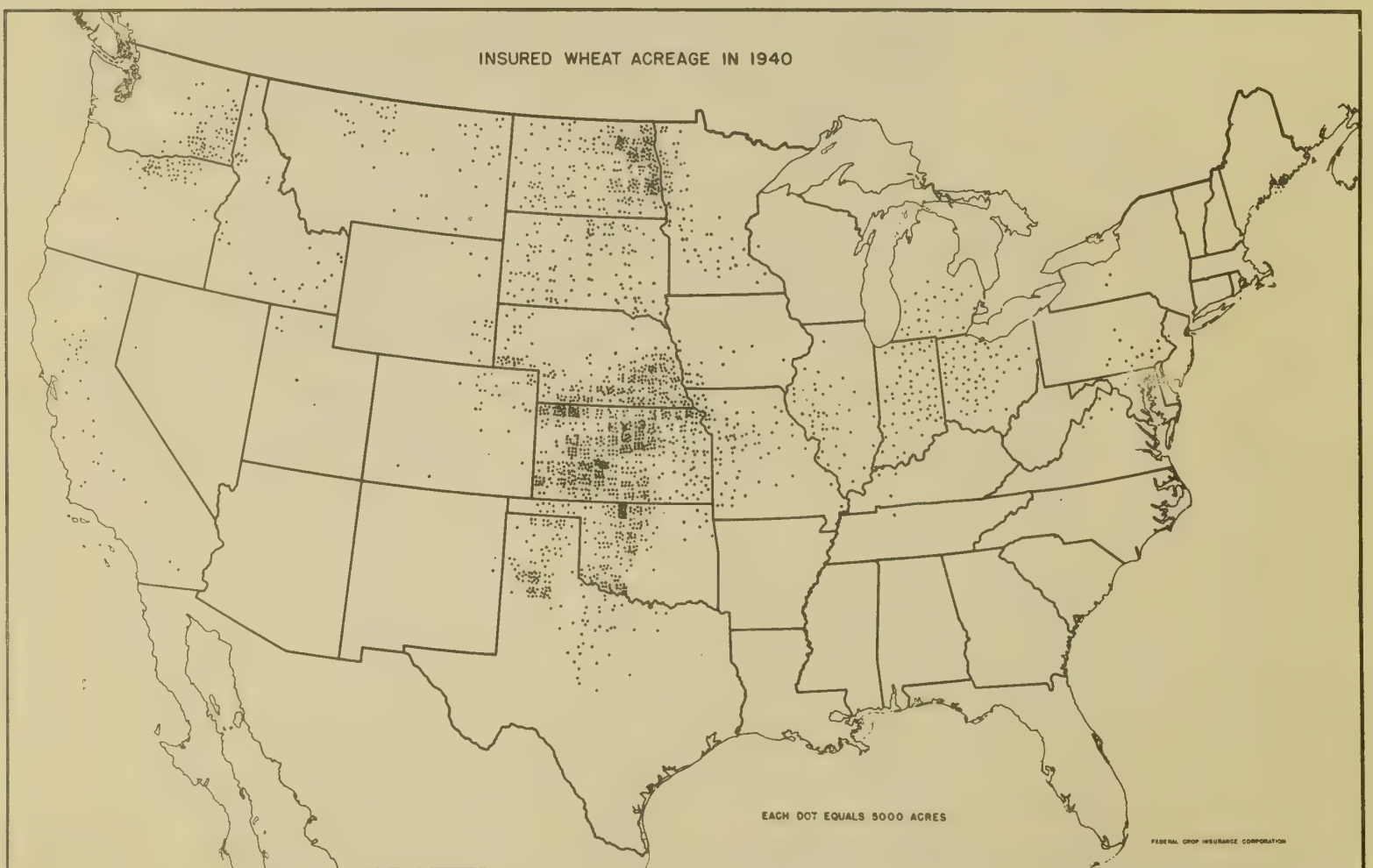


FIG. 14

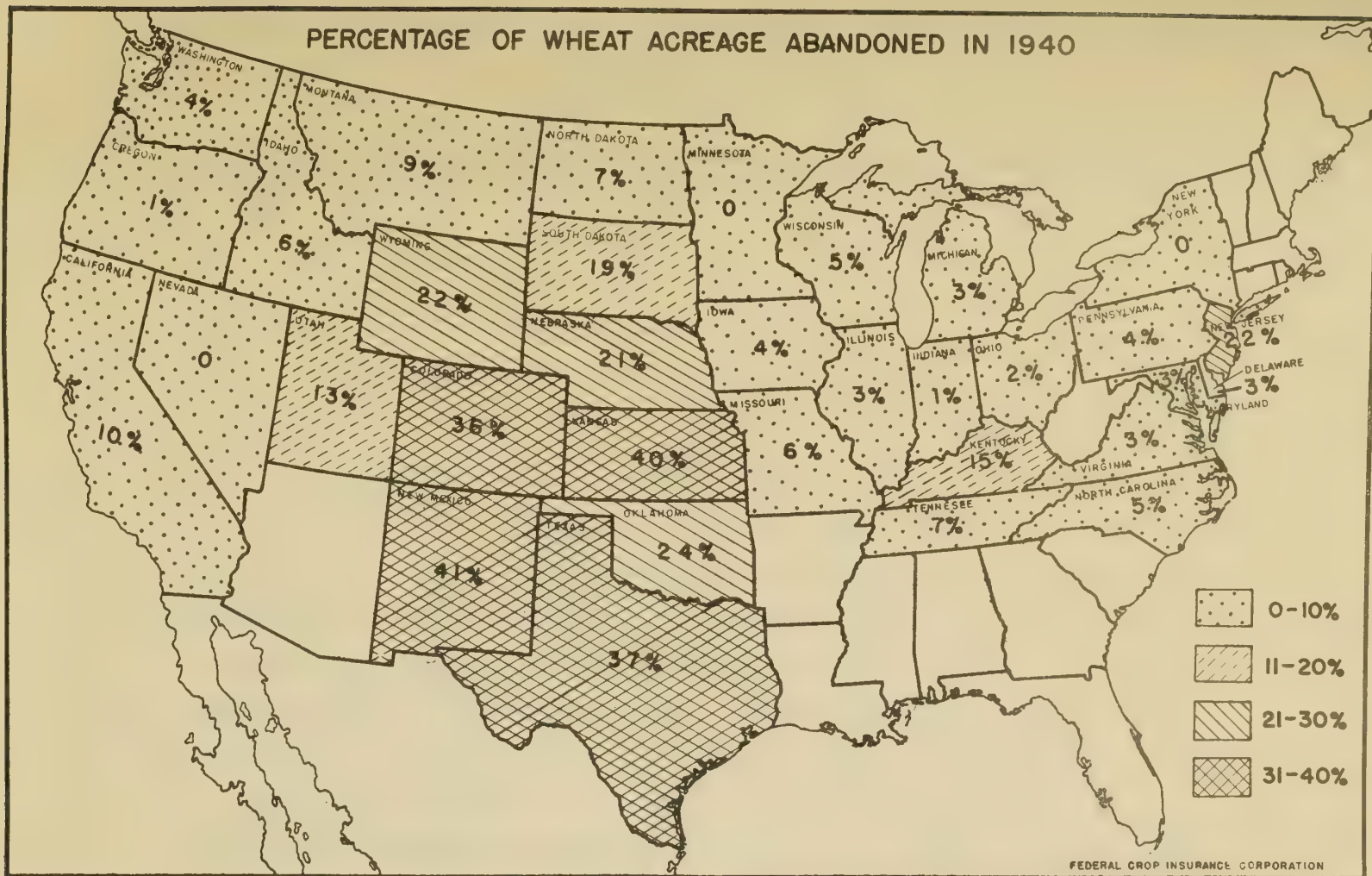


FIG. 15

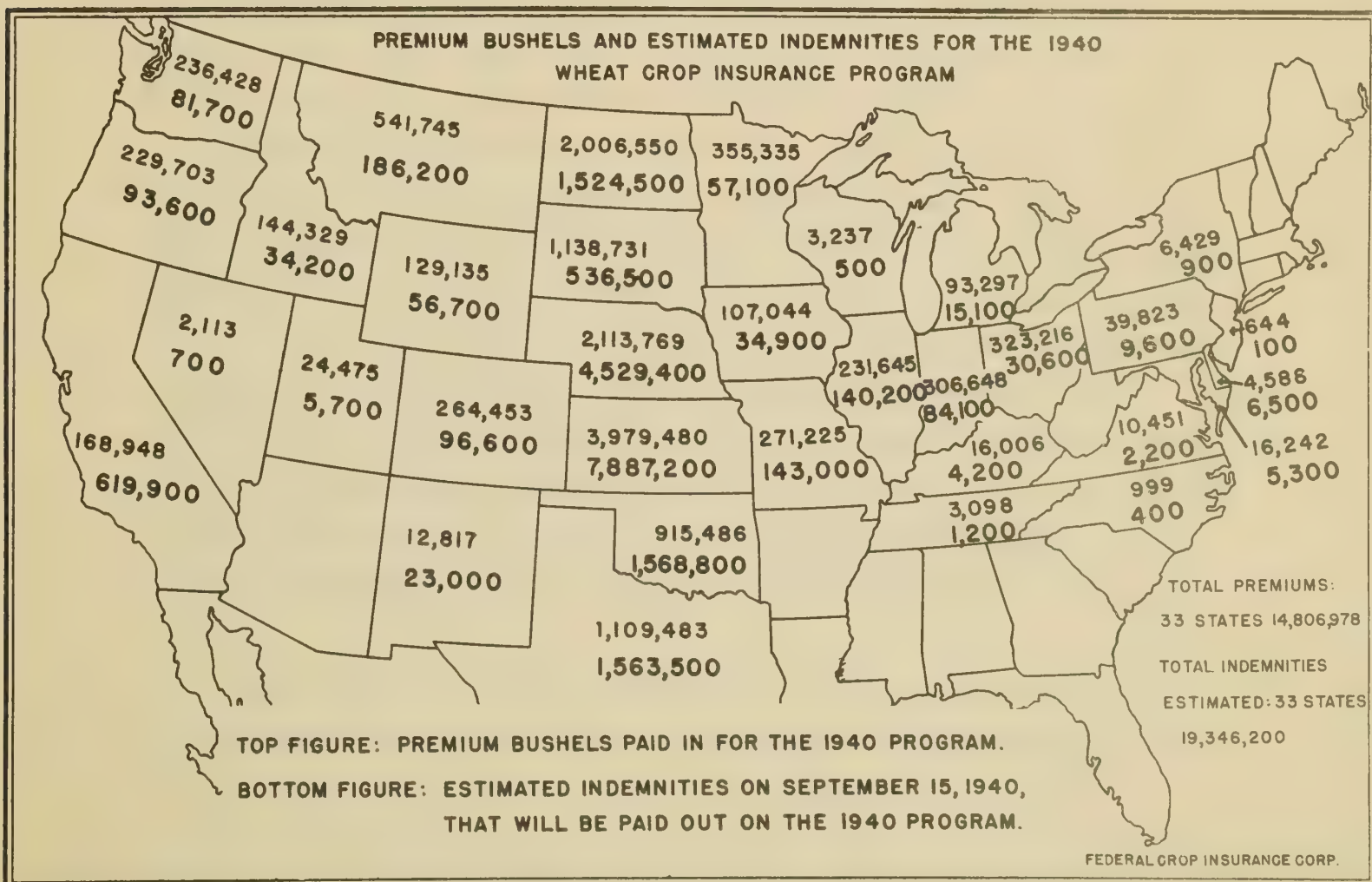


FIG. 16

EXTENT AND DISTRIBUTION OF LOSSES

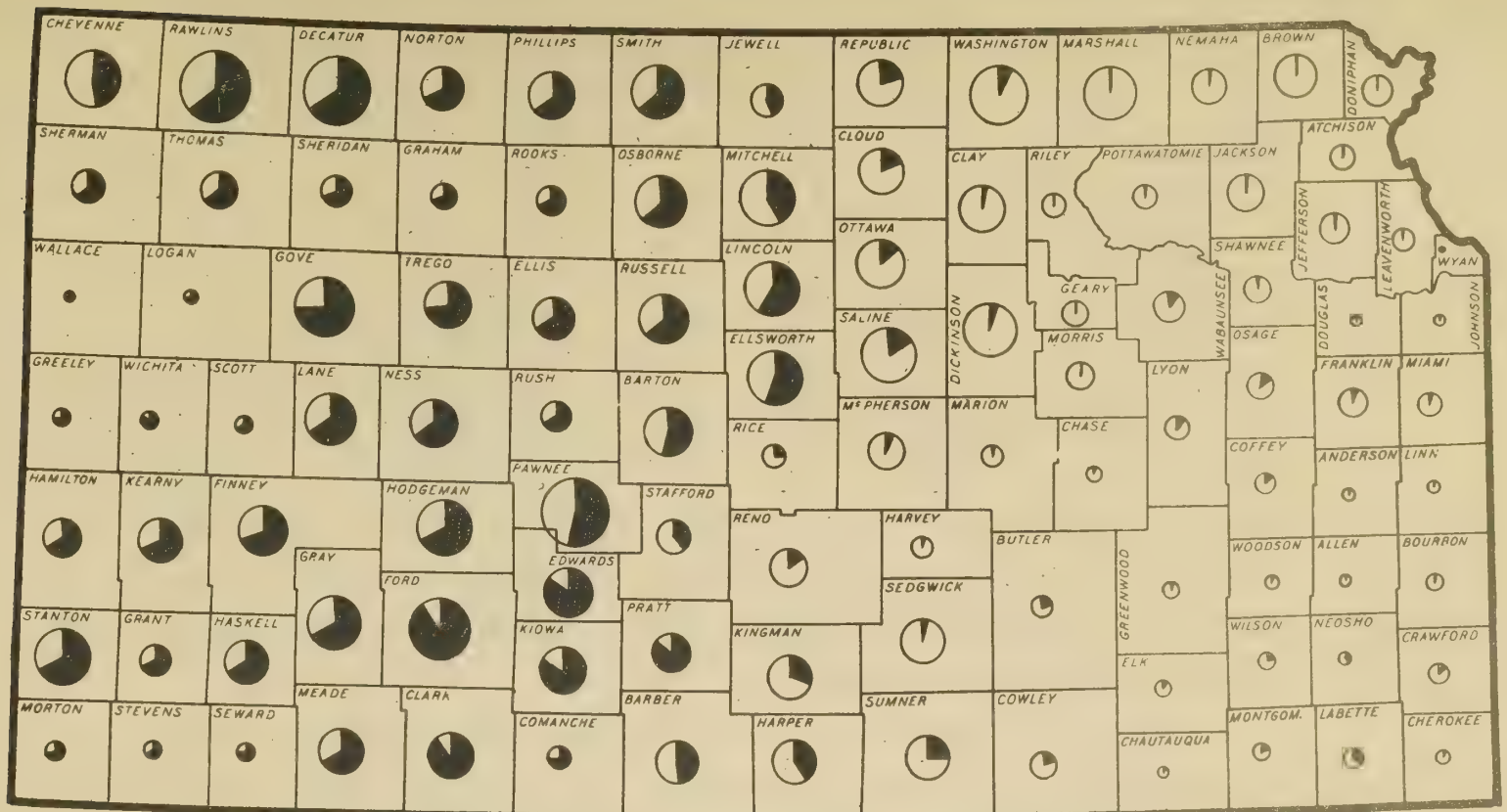
Adjustment of losses and payment of indemnities have not been completed for 1940. However, it has been possible to make some preliminary observations as to the extent of crop damage and to forecast probable indemnities. Figure 15 indicates the abandonment of wheat acreage by states in 1940. Abandonment for all wheat for the Nation as a whole was estimated at 18.2 percent. However, abandonment in the winter wheat area, where 80 percent of the crop insurance contracts were located, reached 24.3 percent in 1940, as compared to 16.9 percent for the 1926-38 average. Thus abandonment was somewhat higher during 1940 in the heaviest insured area than the average for the base period of the insurance. The most serious crop losses in 1940 were experienced by winter wheat growers in the previously mentioned six central and southwestern Great Plains states where 34 percent of all acreage planted was abandoned. In fact, of the total national abandonment of approximately 11,700,000 acres of wheat, the acreage lost in these six states accounted for 9,300,000 acres, or 80 percent of the national total.

Figure 16 indicates the distribution by states of premiums collected and estimated indemnities to be paid on the 1940 crop. It is emphasized that this estimate is purely tentative and will be subject to considerable revision as actual indemnities are completed. This preliminary survey indicates that the Corporation may pay a total of 19,346,200 bushels in indemnities on the 1940 crop. The distribution and extent of estimated indemnities is generally in line with the acreage abandonment figures shown in Figure 15. It is significant that in the six-state winter wheat area, where 80 percent of all wheat abandonment occurred, it is estimated that 81 percent of all indemnities will be paid.

In some counties within the winter wheat area, abandonment was much greater than indicated by the state average figures. In some counties as much as 73 percent of the acreage planted was abandoned. Figure 17 shows the extent of abandonment by counties for Kansas, together with the acreage insured by counties and graphically portrays the extent of crop loss and the amount of insured acreage in this typical hard winter wheat belt state.

The yield record of the 1940 crop is a definite demonstration of the manner in which broad average yields can be extremely misleading as far as crop insurance is con-

Acreage Insured by Counties and Percentage of 1940 Wheat Crop Abandoned in Kansas Counties



CIRCLES REPRESENT NUMBER OF ACRES INSURED IN COUNTY

SHADED AREAS REPRESENT PERCENTAGE OF ALL WHEAT ACREAGE ABANDONED IN COUNTIES

FIG. 17

cerned. In the winter wheat belt most of the acreage abandoned was lost during the fall and winter months, imposing upon many thousands of growers an extremely severe crop loss. However, in the late spring and summer unusually good growing conditions prevailed. Much of the acreage on which the crop survived yielded a so-called "miracle" harvest of phenomenal yields. These high yields helped to bring about a harvested yield for all winter wheat higher than the long-time average but due to the heavy abandonment this will not be the case for yields per seeded acre. Moreover, the high yields on farms where no losses were paid do not offset the heavy losses where the crop was abandoned.

CORRECTIONS BEING MADE

Preliminary analyses of the 1940 yield and loss data indicate considerable improvement over 1939, and such needs for improvement as have been noted have been introduced in the 1941 actuarial structure wherever possible. It should be realized, of course, that 1941 yields and rates were established prior to the 1940 harvest and that final results of the 1940 experience will not enter completely into the actuarial structure until the 1942 yields and rates are established.

Figures 18, 19, and 20 show the comparative relationship of yields and premium rates by counties for the three years 1939, 1940, and 1941. These maps indicate changes in the rate structure, particularly in the areas which have shown consistent losses. The map for 1941 shows that the ratio of premiums to insured yields has increased. Figure 21 shows for the State of South Dakota specific changes in the rates by counties in 1941, as compared to 1940. While it cannot be shown on a map, there has also been considerable revision of individual rates for farms within the county.

1939 County Rates in Percent of Guaranteed Yield
(75% COVERAGE)

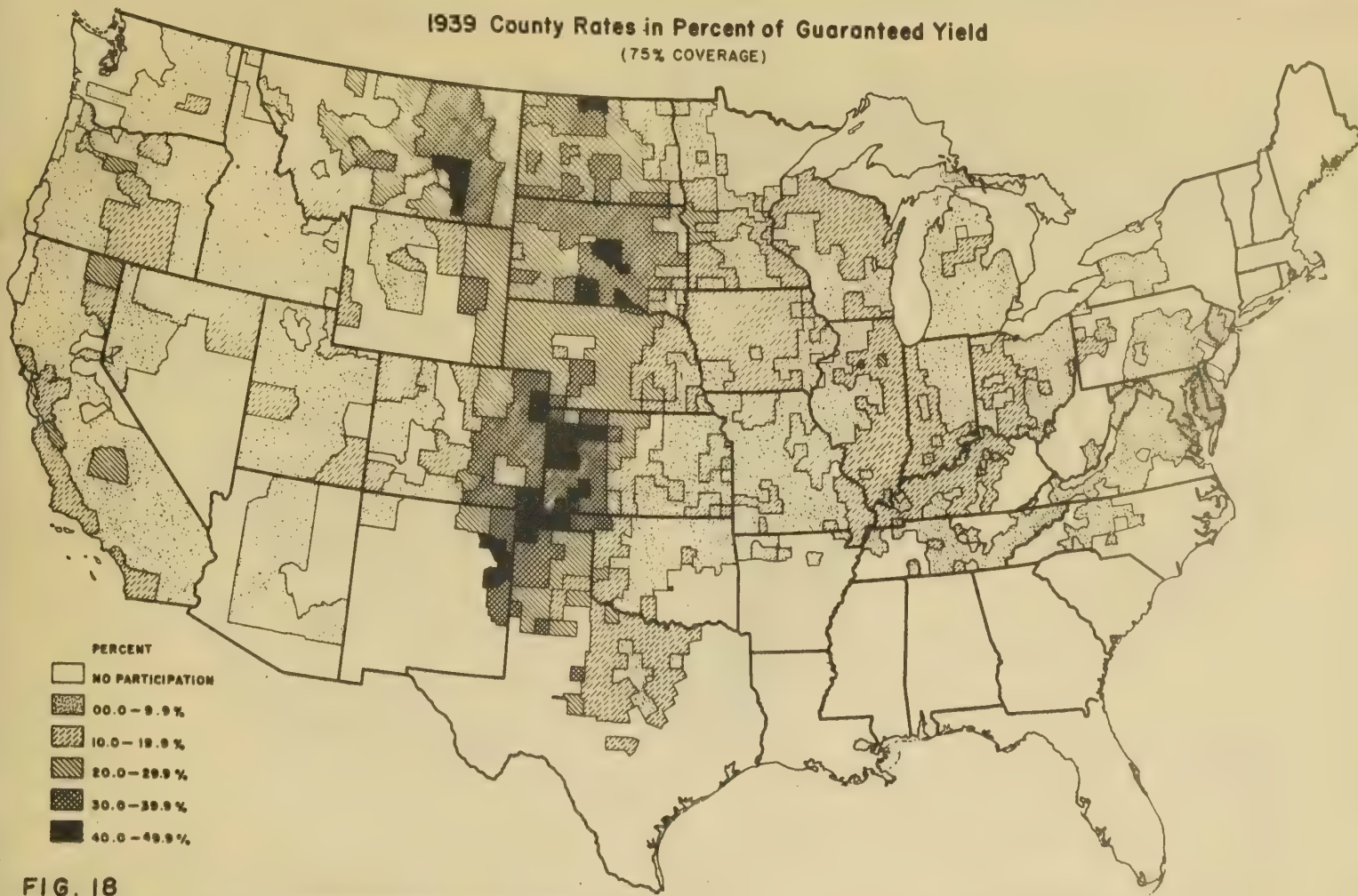


FIG. 18

FEDERAL CROP INSURANCE CORPORATION

1940 County Check Premium Rates in Percent of Guaranteed Yields
(75% COVERAGE)

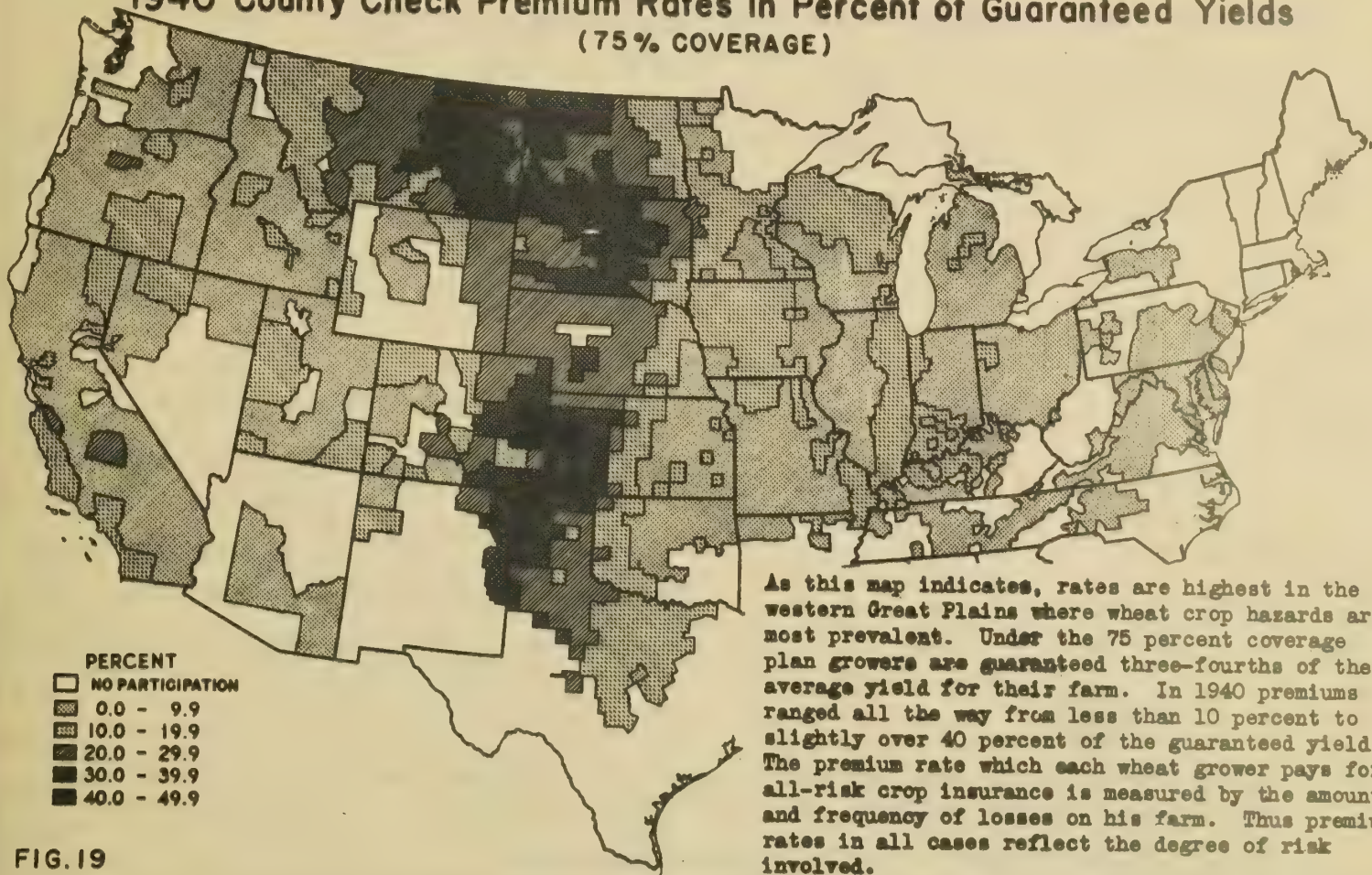


FIG. 19

FEDERAL CROP INSURANCE CORPORATION

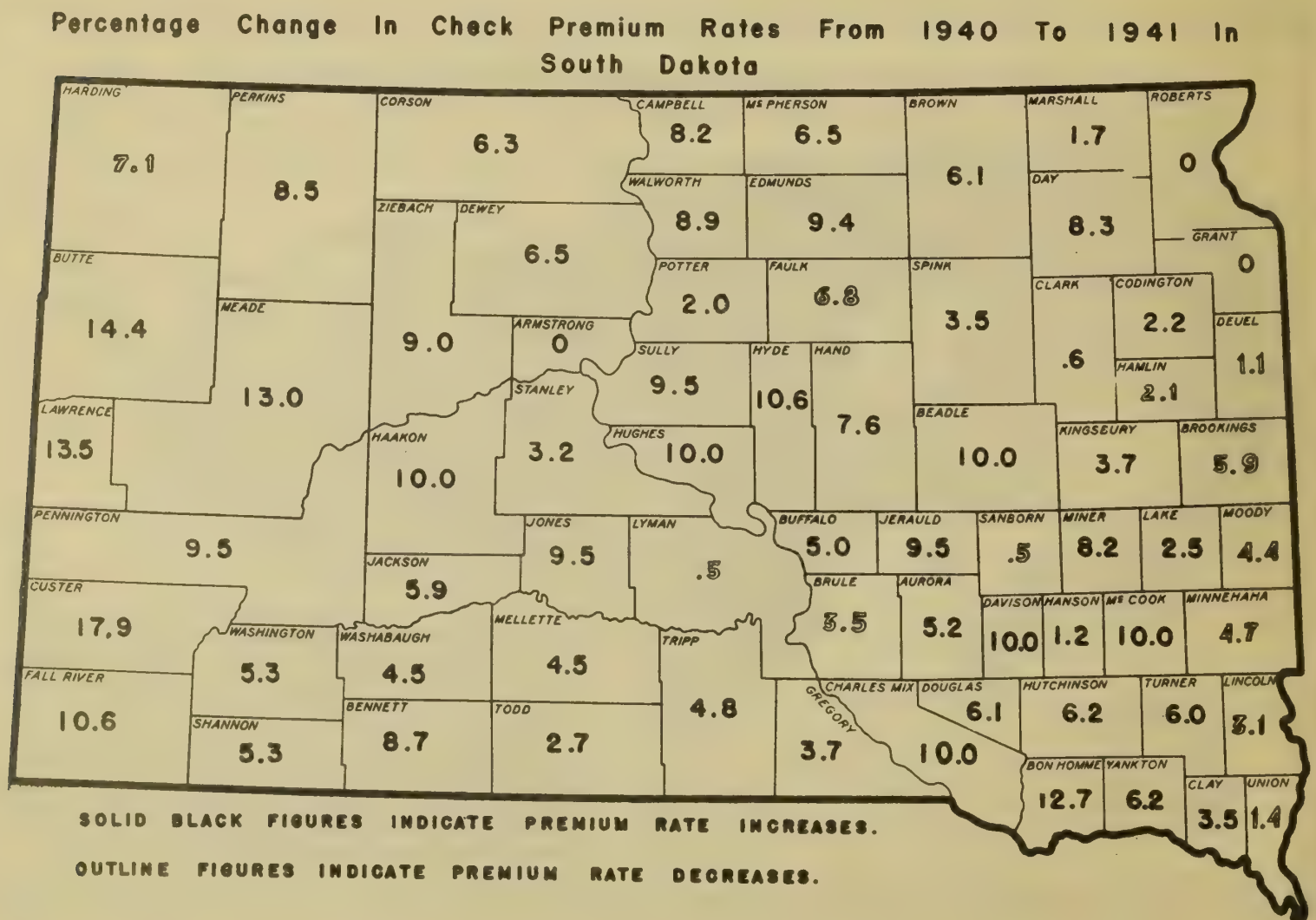
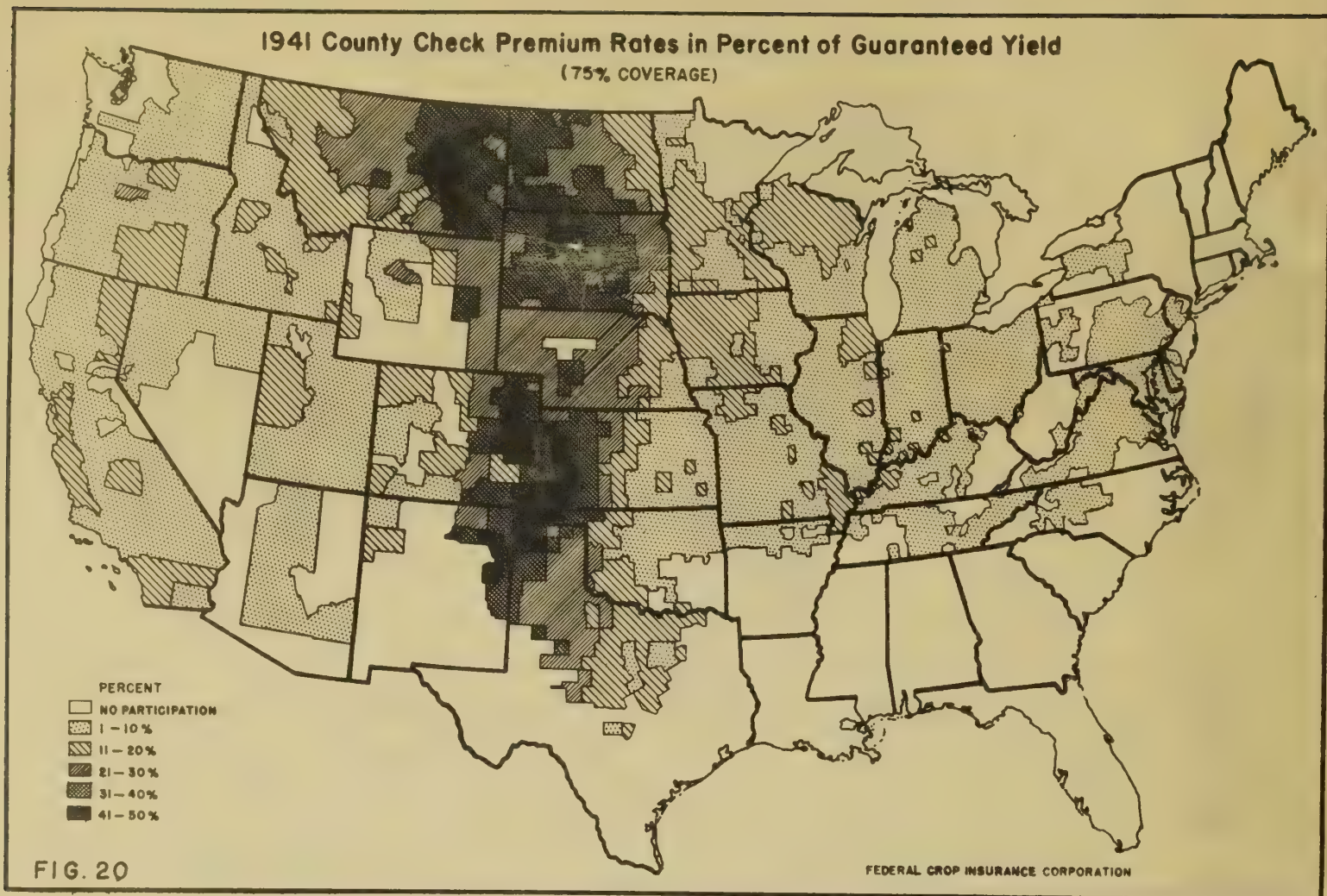


FIG. 21

1941 IMPROVEMENTS

The principal corrections introduced in the 1941 yield and rate structure include:

1. Previously established yields and rates for all farms were rechecked and revised by the county committees.
2. Introduction of actual recorded yields for 1939. Where possible the actual yield on all farms under the ACP program was secured in order to bring the insurance rates up to date and to reflect the latest yield trends. The 1939 yield was blended with the average yield used for the 1940 program, giving it a weight of one-tenth. Crop losses in 1939 also were brought into the rate structure with a weight of one-twentieth.
3. Earlier closing dates were established for receipt of applications and premiums in the winter wheat belt. The one closing date, August 31, applies to all winter wheat states. It is believed to be sufficiently early to eliminate much of this adverse selection of risk on the part of growers. It is difficult to advance the date much further because many farmers do not make their leasing arrangements early enough and because of interference by farm operations.
4. A correction factor was introduced. With the experience of the 1939 program available, it was possible to introduce a correction factor to reflect losses under actual operating experience. The correction factor will affect all county check premium rates.

In the near future the preparation of yields and premium rates for the 1942 program will begin, at which time the actual yield experience of the 1940 crop will be brought into the actuarial picture. Thus each year the Corporation will add new data on yields and losses occurring under actual operating conditions. This will make it possible for the program to move gradually from an improvised base to a base of information obtained through actual insurance experience.

